

In the claims:

1. (original) A system for performing operations on a plurality of workpieces, the system comprising:

an operations portion and a load/unload portion;

a plurality of independently operable work heads located in the operations portion, the work heads each being operable to perform work on the plurality of workpieces;

a transfer system, the transfer system including a plurality of mounting devices, the transfer system being operable to deliver the mounting devices into and out of the operations portion of the system,

the plurality of workpieces being contained in workpiece-holding structures, the workpiece-holding structures being mountable on the plurality of mounting devices;

the load/unload portion being operable to load the workpiece-holding structures onto one of the plurality of mounting devices prior to delivery of the mounting devices into the operations portion by the transfer system to perform work on the plurality of workpieces by the independently operable work heads;

the load/unload portion being further operable to unload the workpiece-holding structures from one of the plurality of mounting devices,

wherein one of the plurality of mounting devices is positioned in the operations portion of the system and work is performed on the plurality of workpieces by at least one of the plurality of independently operable work heads while another one of the plurality of mounting devices is positioned in the load/unload portion of the system and workpiece-holding structures are unloaded from the mounting devices.

2. (currently amended) The system of claim 1, wherein the workpieces are electronic substrates and the work heads are dispensing heads for dispensing a substance onto the electronic substrate.

3. (original) The system of claim 1, wherein the workpiece-holding structures are trays and the trays hold electronic substrates.

4. (original) The system of claim 3, wherein the trays are AUER boats.
5. (original) The system of claim 1, wherein the mounting devices are pallets for holding the workpiece-holding structures.
6. (original) The system of claim 2, wherein the work performed on the workpieces is the dispensing of underfill onto the electronic substrates.
7. (original) The system of claim 1, wherein each of the independently operable work heads further comprises a vision alignment apparatus to align the independently operable work heads to the plurality of workpieces.
8. (original) A method for performing operations on a plurality of workpieces using an apparatus having an operations portion and a load/unload portion; a plurality of independently operable work heads located in the operations portion, the work heads each being operable to perform work on the plurality of workpieces; a transfer system, the transfer system including first and second mounting devices, the transfer system being operable to deliver the first and second mounting devices into and out of the operations portion of the system and out of and into the load/unload portion, respectively; the plurality of workpieces being contained in workpiece-holding structures, the workpiece-holding structures being mountable on the first and second mounting devices; the load/unload portion being operable to load the workpiece-holding structures onto one of the mounting devices and to unload the workpiece-holding structures from one of the mounting devices, the method comprising:
  - (a) mounting the workpiece-holding structures onto a first mounting device prior to delivery of the mounting devices into the operations portion to perform work on the plurality of workpieces by the independently operable work heads;
  - (b) moving the first mounting device into the operations portion using the transfer system to have work performed on the plurality of workpieces by at least one of the plurality of independently operable work heads;

(c) moving the second mounting device using the transfer system to the unload portion;  
(d) when the first and the second mounting devices have been positioned, respectively, at the operations portion and the load/unload portion, performing work on the workpieces on the first mounting devices while unloading workpiece-holding structures from the second mounting device.

9. (original) The method of claim 8, further comprising repeating steps (a), (b) and (c) such that workpiece-holding structures are unloaded from a mounting device after having had work performed on the plurality of workpieces contained in the workpiece-holding structures at approximately the same time period the workpieces which have not had work performed on them are delivered to the operations portion.

10. (original) An apparatus for performing operations on a plurality of workpieces comprising:  
an operations portion and a load/unload portion;  
a plurality of independently operable work heads located in the operations portion, the work heads each being operable to perform work on the plurality of workpieces; and  
a transfer system, the transfer system including a plurality of mounting devices, the transfer system being operable to deliver the mounting devices into and out of the operations portion of the system,

wherein the plurality of workpieces are contained in workpiece-holding structures, the workpiece-holding structures being mountable on the plurality of mounting devices, and

wherein one of the plurality of mounting devices is positioned in the operations portion of the system and work is performed on the plurality of workpieces by at least one of the plurality of independently operable work heads while another one of the plurality of mounting devices is positioned in the load/unload portion of the system and workpiece-holding structures are unloaded from the mounting devices.

11. (new) The system of claim 5 wherein the pallets include removable top plates, the top plates constructed and arranged to accept a plurality of dimensions of workpieces.
12. (new) The system of claim 11 further comprising a top gripper for gripping and removing the top plates from the pallets.
13. (new) The system of claim 5, wherein the pallets include a vacuum, the vacuum being constructed and arranged to secure the plurality of workpieces to the pallets.
14. (new) The system of claim 13 further comprising a detector for detecting a vacuum level on the pallet to determine the absence of a workpiece.
15. (new) The system of claim 1, wherein the work performed on the workpieces includes a pick and place operation.
16. (new) The system of claim 1, wherein the work performed on the workpieces includes an inspection process.
17. (new) The system of claim 1, wherein the work performed on the workpieces includes laser soldering of the workpieces.
18. (new) The system of claim 1, wherein the mounting devices include a vision alignment apparatus to align the workpieces to the mounting devices.
19. (new) The system of claim 1, wherein the transfer system includes an elevator system for holding the plurality of mounting devices.
20. (new) The system of claim 19 further comprising a plurality of magazines positioned in the elevator system, wherein each of the plurality of magazines accepts mounting devices before

the mounting devices are loaded into the operations portion and after the mounting devices are unloaded from the operations portion.

21. (new) The system of claim 20 wherein the magazines are heated.

22. (new) The system of claim 19 further comprising at least two elevator systems for holding the plurality of mounting devices and for delivering the plurality of mounting devices substantially continuously.

23. (new) The system of claim 19 wherein the elevator system includes a sensor for indicating positions of mounting devices within the elevator system.

24. (new) The system of claim 1 wherein the load/unload portion further comprises a conveyor system for substantially continuously loading and unloading the workpieces into and out of the operations portion.

25. (new) The system of claim 24 wherein the conveyor system is heated.

26. (new) The system of claim 2 wherein the dispensing heads include needles for dispensing solder paste onto workpieces.

27. (new) The system of claim 26 further comprising a needle calibrator for calibrating a height position of the needle of each of the multiple dispensing heads with respect to the workpiece.

28. (new) The system of claim 27 further comprising a bent needle detector.

29. (new) The system of claim 2 further comprising a weigh scale for weighing an amount of the substance dispensed onto the workpieces.

30. (new) The system of claim 29 further comprising a predispense plate for receiving an amount of the substance dispensed onto the workpiece prior to beginning a work operation on the workpiece.
31. (new) The method of claim 8 wherein step (a) further comprises:  
pushing the workpiece-holding structures to a partially extended position;  
gripping the partially extended workpiece-holding structures; and  
pulling the workpiece-holding structures to a position on the mounting device for transport into the operations portion.
32. (new) The method of claim 8 further comprising heating the first mounting device prior to moving the first mounting device into the operations portion.
33. (new) The apparatus of claim 10 wherein the workpieces are electronic substrates and the work heads are dispensing heads.
34. (new) The apparatus of claim 10 wherein the workpiece-holding structures are trays and the trays hold electronic substrates.
35. (new) The apparatus of claim 10 wherein the mounting devices are pallets for holding the workpiece-holding structures.
36. (new) The apparatus of claim 35 wherein the pallets include interchangeable top plates, each of the interchangeable top plates being constructed and arranged to accept a plurality of workpieces having differing dimensions.
37. (new) The apparatus of claim 35 wherein the pallets include a vacuum, the vacuum being constructed and arranged to secure the workpiece-holding structures to the pallets.

38. (new) The apparatus of claim 37 further comprising a detector for detecting a vacuum level on the pallet to determine the presence of a workpiece on the pallet.
39. (new) The apparatus of claim 33 wherein the multiple independent dispensing heads are mounted on a common gantry.
40. (new) The apparatus of claim 39 wherein one of the multiple independent dispensing heads dispenses a first pattern onto the electronic substrates and another of the multiple independent dispensing heads dispenses a second pattern onto the electronic substrates.
41. (new) The apparatus of claim 10 further comprising a vision alignment system for aligning the work heads and the workpieces in the operations portion.
42. (new) The apparatus of claim 10 further comprising a needle calibrator for calibrating a height position of a needle of each of the multiple dispensing heads with respect to the workpiece.
43. (new) The apparatus of claim 42 further comprising a bent needle detector.
44. (new) The apparatus of claim 10 further comprising a weigh scale for weighing an amount of a substance dispensed onto the workpiece.
45. (new) The apparatus of claim 10 further comprising a predispose plate for receiving an amount of a substance dispensed onto the workpiece prior to beginning a work operation on the workpiece.
46. (new) The apparatus of claim 10 wherein the transfer system includes at least one magazine in which the mounting devices are positioned, the magazine including a plurality of shelves from which the mounting devices are removed, and to which the mounting devices are returned.

47. (new) The apparatus of claim 46 wherein the at least one magazine includes a sensor to sense the presence of a mounting device in a position in the magazine.
48. (new) The apparatus of claim 10 wherein the work performed on the workpieces includes the dispensing of underfill onto the electronic substrates.
49. (new) The apparatus of claim 10 wherein the work performed on the workpieces includes a pick and place operation.
50. (new) The apparatus of claim 10 wherein the work performed on the workpieces includes an inspection process for inspecting the workpieces.
51. (new) The apparatus of claim 10 wherein the work performed on the workpieces includes a laser soldering process on the workpieces.
52. (new) An apparatus for performing operations on a plurality of workpieces comprising:  
an operations portion and a load/unload portion, the operations portion including a gantry system;  
a plurality of operable work heads coupled to the gantry system, the work heads each being operable to perform work on the plurality of workpieces; and  
a transfer system, the transfer system including a plurality of mounting devices, the transfer system being operable to deliver the mounting devices into and out of the operations portion of the system,  
wherein the plurality of workpieces are contained in workpiece-holding structures, the workpiece-holding structures being mountable on the plurality of mounting devices, and  
wherein one of the plurality of mounting devices is positioned in the operations portion of the system and work is performed on the plurality of workpieces by at least one of the plurality of operable work heads while another one of the plurality of



mounting devices is positioned in the load/unload portion of the system and workpiece-holding structures are unloaded from the mounting devices.

53. (new) The apparatus of claim 52 wherein each of the plurality of operable work heads performs an individual work operation on the workpiece.

54. (new) The apparatus of claim 52 wherein the workpieces are electronic substrates and the work heads are dispensing heads.

55. (new) The system of claim 52 wherein the workpiece-holding structures are trays and the trays hold electronic substrates.

56. (new) The system of claim of claim 52 wherein each of the plurality of operable work heads moves independently in a Y-axis direction to perform an operation on a portion of the workpiece.